

CLAIMS

What is claimed is:

1. A method for removing etching residue from a substrate which comprises contacting said substrate with a composition comprising
 - 5 a. up to about 80% by weight of a water miscible organic solvent;
 - b. about 5 to about 50% by weight of water;
 - c. about 1 to about 20% by weight of a dicarboxylic organic acid;
 - d. about 0.5 to about 20% by weight of a base, which in combination with the above diacid, forms a buffering agent; and
 - 10 e. about 0.1 to about 10% by weight of a source of fluoride ion.
2. The method of claim 1 wherein the dicarboxylic organic acid is selected from the group consisting of oxalic, malonic, succinic, glutaric, adipic acids, fumaric acid, maleic acid, phthalic acid and terephthalic acid.
3. The method of claim 1 wherein the dicarboxylic organic acid is selected from the group consisting of succinic acid, malonic acid, maleic acid, adipic acid and phthalic acid.
- 15 4. The method of claim 1 wherein the dicarboxylic organic acid is maleic acid or adipic acid.
5. The method of claim 1 wherein the dicarboxylic organic acid is adipic acid.
- 20 6. The method of claim 1 wherein the base is selected from the group consisting of ammonium hydroxide, amines, and quaternary ammonium hydroxides.
7. The method of claim 1 wherein the base comprises ammonium hydroxide or monoethanolamine.
8. The method of claim 1 wherein the fluoride ion source is selected from the group consisting of hydrofluoric acid, ammonium fluoride, quaternary ammonium fluorides, fluoroborates, fluoroboric acid, tin bifluoride, antimony fluoride,
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tetrabutylammonium tetrafluoroborate, aluminum hexafluoride, and a fluoride salt of an aliphatic primary, secondary or tertiary amine having the following formula:

$R_1N(R_3)R_2$ wherein R_1 , R_2 and R_3 each individually represent H or an alkyl group.

9. The method of claim 1 wherein the fluoride ion source comprises ammonium fluoride.
10. The method of claim 1 wherein the amount of water miscible organic solvent is about 1% to about 80% by weight.
11. The method of claim 1 wherein the water miscible organic solvent is selected from the group consisting of dimethylacetamide, N-methyl pyrrolidinone, dimethylsulfoxide, dimethylformamide, N-methylformamide, formamide, dimethyl-2-piperidone, tetrahydrofurfuryl alcohol, glycerol, and ethylene glycol.
12. The method of claim 11 wherein the water miscible organic solvent comprises dimethylacetamide, dimethyl-2-piperidone or N-methyl pyrrolidinone.
13. The method of claim 1 wherein the pH of the composition is about 1 to about 7.
14. The method of claim 1 wherein the pH of the composition is about 5.5 to about 6.
15. The method of claim 1 wherein the composition is free from benzotriazole.
16. The method of claim 1 wherein the substrate also includes a material selected from the group consisting of metal, silicon, silicate and interlevel dielectric material.
17. The method of claim 16 wherein the inter-level dielectric material comprises silicon oxides or derivatized silicon oxides.
18. The method of claim 16 wherein the metal is selected from the group consisting of copper, copper alloy, titanium, titanium nitride, tantalum, tantalum nitride, tungsten, titanium/tungsten, aluminum and/or aluminum alloys.